



Icy Satellites in the Cassini Tour of the Saturn System

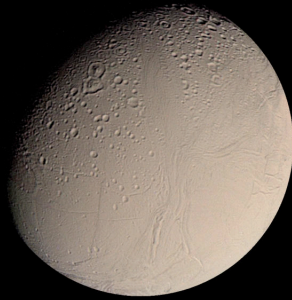
June 1, 2004

Introduction

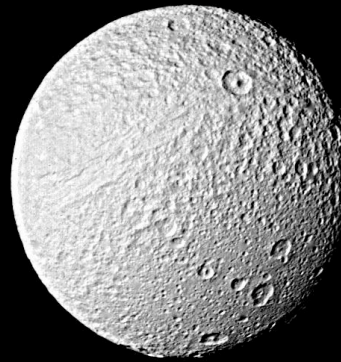
- Saturn has 31 currently known moons (more will likely be discovered by Cassini)
- The Cassini Satellites Orbiter Science Team (SOST) plans the science observations during the flybys of the 8 major icy satellites (not including Titan or the “rocks”)
- Discoveries of the icy satellites:
 - **Iapetus**, **Rhea** discovered by Cassini in 1671, 1672
 - **Dione**, **Tethys** discovered by Cassini in 1684
 - **Mimas**, **Enceladus** discovered by Herschel in 1789
 - **Hyperion** discovered by Bond & Lassell in 1848
 - **Phoebe** discovered by Pickering in 1898
- Water ice is the primary surface component of these moons
 - ammonia and methane are also expected
- These moons are tidally locked (except Phoebe, Hyperion)



Mimas
R=196 km
3.08 R_c orbit



Enceladus
R=260 km
3.95 R_S orbit



Tethys
R=530 km
4.88 R_S orbit



Dione
R=560 km
6.26 R_S orbit



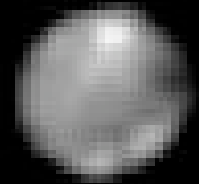
Rhea
R=765 km
8.74 R_S orbit



Hyperion
R=143 km
24.55 R_S orbit



Iapetus
R=730 km
59 R_S orbit



Phoebe
R~110 km
214.7 R_S orbit

Targeted Flyby Summary & Measurements

- 8 targeted flybys are planned:
 - Rev 0 Phoebe (2000 km) (June 11, 2004)
 - Rev 4 Enceladus (500 km) (March 9, 2005)
 - Rev 11 Enceladus (1000 km) (July 14, 2005)
 - Rev 15 Hyperion (1000 km) (September 26, 2005)
 - Rev 16 Dione (1000 km) (October 11, 2005)
 - Rev 18 Rhea (500 km) (November 26, 2005)
 - Rev 49 Iapetus (1000 km) (September 10, 2007)
 - Rev 61 Enceladus (1000 km) (March 12, 2008)
- Additional satellite observations will be made during untargeted flybys when the satellite is relatively close, as well as at more distant ranges.
- Images will help get better coverage of satellites' surfaces to understand the geologic history of moons; spectra (UV-IR) will measure composition and any atmospheric species, as well as surface temperature; RADAR measurements will constrain the bulk density of the surface layers and determine relative ice cleanliness; Radio Science measurements will constrain the density of the moons, to tell us about the internal structure; fields and particles instruments will measure charged and neutral particles and dust in the environments of the icy satellites.

General science questions and goals/observations

- What is the compositional makeup of the icy satellites?
- What are the effects of the E-ring on the satellites and vice versa?
- Are any of the satellites currently geologically active?
- What is the interior structure of the icy satellites?
- How did Mimas and Tethys survive the impacts that created the very large craters Herschel and Odysseus?
- What is the source of the wispy streaks on Rhea and Dione?
- What is the source of Iapetus' striking albedo dichotomy?
- Why does Hyperion rotate chaotically?
- Where did Phoebe come from? Is it a KBO?